

## Some Recurrent Issues in the History of Behavioral Sciences

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Many issues seem to have appeared, disappeared, and reappeared in the behavioral sciences during the 20th century. Salient examples discussed in the present paper are consciousness, including the concept itself and consciousness in nonhuman animals; the method of introspection; and cognition, including the interpretation of mental imagery and the role of language in thinking. One possible explanation of the apparent cycles is consistent with a suggestion by John B. Watson: Important issues are found to be intractable and are abandoned, but they recur when newer theories and methods emerge.

*Key words:* cognition, consciousness, history of behaviorism, history of cognitive psychology, imagery, introspection

The notion that issues and ideas recur repeatedly has itself recurred repeatedly. Aristotle said it in virtually the same way twice: “The same ideas, one must believe, recur in men’s minds not once or twice but again and again” and “The same opinions appear in cycles among men not once nor twice, but infinitely often” (respectively, Aristotle, *On the Heavens*, Book 1, chap. 3, 1952b, p. 361; *Meteorology*, Book 1, chap. 3, 1952a, p. 446). The poet Robert Frost (1914) made a similar point:

... why abandon a belief  
Merely because it ceases to be true.  
Cling to it long enough; and not a doubt  
It will turn true again, for so it goes,  
Most of the change we think we see in life  
Is due to truths being in and out of favour. (pp. 54–55)

Paraphrased to refer to issues and their felt importance, Aristotle’s and Frost’s points are directly relevant to modern behavioral sciences. Many issues in the behavioral sciences waxed and waned in recurrent cycles during the 20th century (for a sample of references, see

Reese, 1991, 1993; S. White, 1991). Some salient examples—all related to *mind*—are discussed in the present paper: consciousness, introspection, cognition, mental imagery, and the role of language in thinking. I will argue, however, that literal recurrence of issues is rare and that the norm has been recurrence of labels. I suggest one interpretation of the recursions in the last section; I leave other possible interpretations to professional historians.

### CONSCIOUSNESS

#### *The Concept of Consciousness*

*Submergence and reemergence.* The major battle in psychology during the first two decades of the 20th century, with skirmishes fagging out in the third decade, was between classical structuralist psychology and classical functionalist psychology. Both dealt with consciousness; but as the labels imply, the primary goal in structuralism was to understand the structure and contents of consciousness, and the primary goal in functionalism was to understand the functions or uses of consciousness (Carr, 1930). Examples of the difference can be seen in structuralist and functionalist research and theory on imagery, discussed in a later section.

The logical positivist Bergmann (1956) characterized Watson’s behaviorism as a footnote to functionalism,

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but it was more than that, because consciousness was an epiphenomenon for Watson (e.g., Watson, 1913) and was a causal phenomenon for the functionalists (e.g., Calkins, 1921, 1922; Claparède, 1937, pp. 72, 75–76; Woodworth, 1918).

In his 1913 paper, Watson said that “*behaviorism* is the only consistent and logical functionalism” (p. 166), but he explicitly rejected “functional psychology” as well as structuralism, and in 1920 he said that behaviorism ignores consciousness

in the same sense that chemistry ignores alchemy, astronomy horoscopy, and psychology telepathy and psychic manifestations. The behaviorist does not concern himself with them because as the stream of his science broadens and deepens such older concepts are sucked under, never to reappear. (p. 94)

Thus, Watson had started a revolution against functionalism as well as structuralism, and as he had prophesied in the quoted statement, the revolution succeeded in eliminating the concept of consciousness from mainstream psychology.

However, Watson was often overly optimistic, and he was overly optimistic here, in that the cognitive revolution brought about what J. R. Anderson (1990, p. 9) referred to as “the reemergence of cognitive psychology.” Nevertheless, although cognitive psychology has resemblances to both structuralism and functionalism, the concept of consciousness came back transformed. The resemblance to structuralism is in the cognitive processes (operations, productions, etc.) and their products (memories, lexicons, etc.) stored in various structures (networks); the resemblance to functionalism is in the uses to which the cognitive processes and stored products are put, either consciously (deliberately) or unconsciously (automatically).

Despite the modern resemblances, classical structuralism and functionalism did not survive the behavioristic revolution, and unlike the biblical Lazarus, they never rose from the grave. Some of the technical terms came

back, but they referred to new concepts, they appeared in different kinds of theories, and they were studied with different kinds of methods and for different purposes. In fact, the literal return of an idea is rare, because remembrance of things past always occurs in the present and is refracted by the present as well as by past events that intervened between the remembered one and the present remembrance of it (Kvale, 1977; Riegel, 1977). As Kvale (p. 168) said, “An original silence has in recollection become the silence-before-the-thunder; the silence is now remembered ‘through’ the thunder.” James (1890) made the same point almost 90 years earlier: “*The knowledge of some other part of the stream [of thought], past or present, near or remote, is always mixed in with our knowledge of the present thing*” (p. 606).

*The definition of consciousness.* The words *consciousness*, *mind*, and *psyche* have been used as at least rough synonyms from ancient Greek philosophy to the present, but the underlying concept was never adequately defined—nor is it defined in Uttal’s (2000) book *The War Between Mentalism and Behaviorism: On the Accessibility of Mental Processes* (for discussion, see Reese, 2001). In fact, in classical structuralist psychology it was generally acknowledged to be undefinable. James (1890, p. 225) said of consciousness, “Its meaning we know so long as no one asks us to define it.” Ladd (1896, p. 3) went even further in asserting that consciousness “can never be defined.” Washburn (1916, p. 17) said that consciousness is an “ultimate notion,” like “space,” and that “everyone knows what we mean.” Nevertheless, she offered a definition: “Consciousness is that which is present when we are either awake or dreaming, and which is absent when we are dreamlessly asleep.” Dewey (1891, p. 2) had earlier rejected Washburn’s kind of definition: “Consciousness can neither be defined nor described. . . . It cannot be defined by discriminating it from the

unconscious, for this either is not known at all, or else is known only as it exists for consciousness." Rignano said, "There is probably no word which has been more discussed, or whose meaning remains more obscure, than the word consciousness" (1923, p. 359; the quotation is from a book that was evidently popular—it was originally published in Italian and was translated into French and Spanish as well as English; see Murchison, 1929, p. 509). Watson (1924–1925, p. 3) pointed out that the structuralists never really defined it; and Dunlap (1926) said that it meant both introspective observing of something and the thing observed by introspection.

In a 1996 dictionary of psychology, Sutherland defined *consciousness* as "The having of perceptions, thoughts, and feelings; awareness" (p. 95). Including "awareness" as a meaning has both old and modern precedents. For example, Rignano used this meaning in 1923 (chap. 16), Prince commented in 1926 that "consciousness" and "awareness" were often used as synonyms, Matlin used the "awareness" meaning in 1983 (p. 41), and Blake used it in 1997. Very little if any progress has been made in a century of research on consciousness. We are not even closer to having a satisfactory definition of the term. Substituting "awareness" does not help, because it also lacks a satisfactory definition except when it refers to self-description (as in Skinner, 1969, pp. 244–247) and when it refers to knowing (as in saying "I am aware that Sigmund Koch misunderstood behaviorism"), which are not the meanings that were ever wanted for *consciousness*. The phrase "conscious awareness" is also used, but it is misleading because it sounds like it means awareness of being aware but is actually used as a synonym of *awareness* and *consciousness* (e.g., in Blake, 1997). Consciousness—or *mind*, to use the currently preferred synonym—plays a crucial role in information-processing theories, and information-processing theorists have provided clear

criteria for distinguishing between conscious (deliberate) and unconscious (automatic) mental phenomena. However, Shallice (1972) pointed out that information-processing theorists did not deal adequately with the meaning of *mind*. In short, then, Sutherland (1996) had some justification for ending his definition of consciousness with "Nothing worth reading has been written on it" (p. 95).

### *Consciousness in Animals*

Another issue about consciousness is its occurrence in nonhumans. The most extreme approach is to attribute consciousness to subatomic particles, such as the photon in mystical interpretations of physics (Zukav, 1979, pp. 63, 283). However, even panpsychists generally stop short of attributing consciousness to inorganic matter.

The 19th-century novelist and amateur scientist Samuel Butler (1894/1968, pp. 83–84) attributed consciousness to a fly and a cat that he observed. Almost a century later, Griffin (1984) also attributed consciousness to non-human animals, crediting them with mental acts such as deliberately communicating, planning, weighing alternatives, and choosing to act. He did not limit the attribution of consciousness to primates, but included other mammals such as otters and nonmammals such as birds and even some insects. He cited behaviors that admittedly seem amazing, and he found greater plausibility in explaining these behaviors as based on mind than as based on instinct or learning. In fact, he said that even if these behaviors were learned, they can plausibly be attributed to animals' current "thoughts and feelings" (p. 463).

A more reasonable approach, which recurs periodically, is to make the attribution metaphorically. Watson (1913) condemned this approach as only analogical, but Vaihinger (1925) legitimized it in his philosophy of "as if." In this philosophy, a proposition that is acknowledged to be a fiction is

justified if it is shown to be a *useful* fiction (pp. 74–76, 85–90). Alverdes (1932, pp. 19–21) used an “as if” approach in saying that he attributed consciousness and purpose to animals because the attribution is reasonable and useful even though it is a “fiction.” It is a fiction because the question of consciousness and purpose in animals cannot be answered on the basis of scientific evidence. “A fiction [of this kind] is a construction which brings into connection with one another various kinds of processes or things in a manner which enables us to think about them” (p. 137). Mach (1914, chap. 5) had a similar view: Teleological explanations are acceptable if they are understood to be provisional and held only until “causal” explanations are found (his quotation marks, e.g., pp. 86, 98, 335).

More recently, Adler and Tso (1974) used the metaphorical “as if” approach in a study of responses of *Escherichia coli* to simultaneously presented chemicals that when presented alone arouse movement toward or away from the chemical. The title of Adler and Tso’s report referred to *decision-making*, but they put the word “decision” in quotation marks. In the text, they referred to *conflict* in the bacteria and said that the bacteria *decide* which responses to make, but they put “conflict” and “decide” in quotation marks and thereby gave bacteria only an “as if” consciousness.

When the metaphorical approach is fruitful, it is entirely reasonable from the perspective of the contextualistic worldview (Pepper, 1942; Reese, 1999). For other examples of the approach and its relation to Vaihinger’s (1925) philosophy of “as if,” see Reese (1999).

### *Explanation of Consciousness*

A few modern-era cognitive psychologists attempted to explain consciousness, but the value of their contributions is questionable. Several at-

tempts are summarized in the following paragraphs.

*Self-contradictory attempts.* Sperry (1969) said that “conscious awareness” is

a dynamic emergent property of cerebral excitation. As such, conscious experience becomes inseparably tied to the material brain process with all its structural and physiological constraints. At the same time the conscious properties of brain excitation are conceived to be something distinct and special in their own right. They are “different from and more than” the collected sum of the neuro-physico-chemical events out of which they are built. (p. 533)

This is a muddled view, because on the one hand consciousness is said to be inseparable from and fully constrained by brain activity, but on the other hand consciousness is said to be an emergent process and not to be entirely reducible to brain activity. Because it is both material and immaterial, it is simultaneously embodied and disembodied, natural and supernatural—despite Sperry’s assertion that “the present proposal may be said to place mind over matter, but not as any disembodied or supernatural agent” (p. 533).

Psychologists in the late Soviet Union were Marxists and therefore they had a worse problem than Sperry’s, because Marxism entailed adopting a materialistic monism and rejecting mechanistic reductionism. Their materialism reduced mind to brain activity, and at the same time their anti-mechanism affirmed mind–body dualism. They solved the problem by making mind ontologically reducible to brain activity and epistemologically irreducible, thus having mind ontologically material, embodied, and natural and epistemologically ideal, disembodied, and supernatural (Payne, 1968, pp. 17–30, 95–99, 162–164).

Sperry (1969) did not really resolve the self-contradiction in his theory because he asserted rather than demonstrated the absence of contradiction. In contrast, the Soviet psychologists resolved the self-contradiction in their theories by assigning the opposite notions to different categories, one onto-

logical and the other epistemological. Given this assignment, interpreting the notions as contradictory would be making a Rylean "category-mistake" (Ryle, 1949, chap. 1). A category-mistake is made when members of different categories are conjoined in a way that is valid only for members of the same category, as when the description of a stimulus is compared with the sensations the stimulus arouses or when an event at one level of analysis or observation is used to explain an event at another level.

*Property-based attempts.* Other theorists avoided self-contradiction by limiting the scope of their physiological explanations to selected properties of consciousness. For example, Shallice (1972) attributed selected properties of consciousness to "selector inputs" that control "action systems" in the brain. However, he based the properties he attributed to the brain on G. A. Miller, Galanter, and Pribram's (1960) TOTE theory, which was extremely important in the emergence of cognitive psychology but was quickly left behind. Furthermore, Tononi and Edelman (1998) noted that many attempts at neuronal explanations of consciousness attributed to neurons properties that neurons cannot have, thus making a Rylean category-mistake. They did not cite Shallice's theory, but it involves this category-mistake. For example, in Shallice's theory the selector input *determines* whether a particular action system will be maximally activated and *sets the goal* of the action system. In short, "selector input" is the same as the "executive" in information-processing theories, and expressing it in neurological-sounding terms does not make it neurological (e.g., Reese, 1982, 1996).

Tononi and Edelman (1998) nevertheless used a property-based approach to consciousness. Specifically, they said that any conscious experience is integrated (a unity), differentiated (rapidly shifting), private, and fast (occurring within fractions of a second); they explained these properties by reference

to analogous properties in certain distributed neural activities that constitute a cluster they called a "dynamic core." Problems with their explanation are that they did not define consciousness, or even mention that defining it is an issue; they attributed it not only to humans but also to monkeys and, by implication, cats; and they made the "dynamic core" a kind of homunculus in attributing to it the property of being "able to select . . . among a large repertoire of different activity patterns" (p. 1850). Tononi and Edelman apparently did not recognize that they were making the same kind of category-mistake as Shallice, or that the analogical relation between the properties of the dynamic core and properties of conscious experience constitutes a kind of category-mistake because analogies are not explanations—not even in Vaihinger's (1925) philosophy of "as if."

#### *Arousal of Consciousness*

Shallice's (1972) theory of consciousness, discussed above, was essentially similar to Washburn's theory presented in her 1916 book, *Movement and Mental Imagery*, which he did not cite. One assumption in Washburn's theory has appeared in other forms in many other theories. The assumption is that blocking an ongoing process arouses consciousness. In Washburn's theory, the assumption was that when an incipient movement is blocked by excitation of an antagonistic movement, a specific kind of neural process is activated and is accompanied by consciousness.

In other theories, the assumption was that behavior is habitual, routine, and nonconscious unless an obstacle arises and the behavior is blocked. The obstacle (or the blocking) constitutes a problem to be solved, and it activates conscious ("deliberate," "voluntary") problem-solving activities. This idea appeared, for example, in the 1910s and 1920s in the "dynamic psychology" of Woodworth (1918, pp. 138–

139) and in works by the Swiss psychologist Claparède (1925). Both Woodworth and Claparède were functional psychologists. The idea was expressed in the 1930s by the Marxist Russian psychologist Vygotsky (1934/1962, p. 88) and the American psychologist Dewey (1933, p. 108), who was one of the founders of pragmatism (e.g., Dewey, 1905). More recently, it was expressed by the Georgian psychologist Uznadze (1966, pp. 109–119) and the North American psychologists S. White (1965), Garry and Kingsley (1970, p. 463), Meacham and Emont (1989), J. R. Anderson (1990, p. 221), Pascual-Leone (1990), P. H. Miller and Seier (1994), and Reese (1994).

An unresolved issue is whether the consciousness that is aroused is a cause of the problem-solving activities or is merely an epiphenomenal property of the problem-solving activities. According to some theories, it is causal, at least in the sense that it inhibits the previously ongoing habitual behavior (e.g., Dewey, 1933; S. White, 1965). According to behavior-analytic theory, it is caused; therefore, either it is not causal or it can be ignored in explaining behavior because citing its causes is sufficient (e.g., Keehn, 1964; Skinner, 1969, chap. 8, especially p. 258). All the views cited are essentially functionalist, however, because they refer to what consciousness is good for rather than what its contents are like. Nevertheless, many behaviorists have been interested in the contents of consciousness, as indicated in the next section.

### *Introspection*

In classical structuralist psychology, the primary method for studying consciousness (mind) was *introspection*. Watson rejected the method in his 1913 paper, but it continued to be used into the 1930s (for a sample of references, see Beebe-Center, 1951, p. 257; Graham, 1951, p. 903; Reese, 1968, footnote 6, p. 9). It eventually disappeared,

only to reappear later in a new guise presaged by Watson in 1920.

*The classical interpretation.* J. R. Anderson (1990, p. 7) said, "Introspective psychology was not well accepted in America" because at the turn of the century American psychology consisted largely of armchair speculation and was already pragmatic and functional. Although in other respects Anderson's textbook is outstanding, its historical accuracy in this respect can be challenged. For example, functionalism originated at the University of Chicago, which was the home base of pragmatism, and indeed was at first associated with pragmatism. However, one of the founders of functionalism (Angell, 1907), who was at the University of Chicago, distinguished between pragmatism and functionalism, as did the later functionalist Carr (1930). Another example is that the journals of the 1910s and 1920s contain many articles by behaviorists attacking the classical method of introspection (e.g., Fernberger, 1922; Watson, 1920; Weiss, 1922), but also many articles by mentalists describing it (e.g., English, 1921; Titchener, 1912; Washburn, 1922), and other articles by mentalists defending it and often attacking behaviorists for rejecting it (e.g., Crosland, 1922; McDougall, 1926; Washburn, 1922). J. R. Anderson cited "William James's (1890) *Principles of Psychology*" as documentation for his comment, but he cited no specific page, chapter, or even volume. Actually, James (1890, p. 185) said, "*Introspective Observation is what we have to rely on first and foremost and always.*" He devoted almost 11 pages to discussion of the method (pp. 185–192, 194–198) and fewer than 3 pages to discussion of experimental and comparative methods of studying consciousness (pp. 192–194). Dewey (1891, pp. 6–9) said that introspection is the direct method for studying consciousness and that experimental methods are indirect (p. 9); more than a century later Chalmers (1999) said much the same thing: The major

issues for a “science of consciousness” are (a) to avoid the problems inherent in obtaining “direct knowledge of subjective experiences,” which “stems from our first-person access to them,” and (b) to relate these “first-person data” to third-person observations that are objective but indirect.

In classical structuralist psychology, introspection was a special method that required careful training in procedures and in the use of a constrained technical vocabulary (e.g., English, 1921; James, 1890, pp. 185–192, 194–198; Titchener, 1912). It was believed to be a method for direct or, if the introspection was delayed, indirect observation of consciousness; that is, after appropriate training, the introspector’s reports were interpreted as accurate descriptions of the actual contents of consciousness or of memory images of these contents (Titchener, 1912). This was the received interpretation, expressed for example by Dewey (1891, pp. 6–9), Ladd (1896, pp. 6–8), Washburn (1916, p. 18), and Woodworth (1918, pp. 32–34).

*The behavioral interpretation.* Burt (1964) said,

In studying differences in imagery or in investigating the “laws” of colour-mixture the psychologist is concerned, not with the subject’s verbal responses as such, but with *what* the subject reports: it is not the man’s outward and visible behaviour that interests him, but the nature of his inner experience. (p. 95)

Although he thought he was criticizing the behavioral interpretation of verbal reports, he was actually agreeing with it. Watson (e.g., 1913, 1920) rejected the classical interpretation of introspection because he denied that introspection is factually accurate. However, far from rejecting the use of self-reports, he (1920) outright *recommended* them as a type of data on which to base inferences about thinking and other objectively unobservable behaviors. Washburn (1922) understood the part about self-reports as providing symptomatic evidence, and she even suggested that behaviorists might substitute for the word “introspection” the

phrase “symptomatic language behavior” (p. 96). Nevertheless, like other nonbehaviorists then and later, she missed the part about what is to be inferred. She said, “The behaviorist, of course, denies that mental processes exist” (p. 105). That error has continued to be popular among nonbehaviorists (one example is Schwitzgebel, 1999). Actually, however, even though Watson denied that the word *mental* is useful, he theorized at length about how behaviorism can explain “thinking.” He devoted two chapters of his book *Behaviorism* to “thinking” (chap. 10–11 in 1924–1925, 1930) and in his 1920 article he asserted not only that “thinking” occurs but that behaviorists should study it by using, for example, a “think aloud” method (p. 89 and *passim*). He interpreted this method in the same way as the modern cognitivists Ericsson and Simon (1993); indeed, they cited Watson on the method (pp. 57–59) and implicitly endorsed his interpretation of it (pp. 372–373). Spence (1948) explicitly endorsed this interpretation, but without attributing it to Watson.

In a 1931 chapter on research methods in child psychology, J. E. Anderson discussed introspection in apparently the classical sense, but this kind of introspection had already been rejected in mainstream American psychology. Behaviorism had won the field, and although remnants of the old guard continued to use the classical method, it was replaced in the mainstream by the kind of introspection Watson called thinking aloud; it was usually called “verbal self-report.” The major change was that in the mainstream these reports were—and often still are—interpreted as behavior, that is, facts in need of analysis and interpretation (e.g., Ericsson & Simon, 1993, chap. 1). In short, as Hilgard (1980) remarked, introspection was used again but in a new way. The new use involved skepticism about the factual accuracy of the report, based in part on the argument that much of mental life is unconscious and hence

unavailable to introspection (e.g., Skinner, 1969, p. 225; see also references in Uttal, 2000, pp. 92–100; P. White, 1980). Other reasons, which were recognized by the classical introspectionists, are that introspective self-reports are prone to certain errors such as the “language fallacy,” which is fallaciously reporting internal states that have names and overlooking ones that do not have names (English, 1921; James, 1890, pp. 194–197); the “psychologist’s fallacy,” which is confusing the theoretical interpretation of a state with the state to be described (James, 1890; English mentioned a similar error); and—the most famous one—the “stimulus error,” which is describing the external object rather than the internal state it arouses (e.g., English, 1921; James, 1890; Titchener, 1912; Washburn, 1922).

Leeper (1951) held on to the older interpretation, maybe unintentionally. He said, for example, that in experiments on concept formation, “introspective reports have *disclosed* [italics added] that the subjects typically engage in an extremely active exploratory process, often formulating, testing, and discarding hypotheses within single trials” (p. 736); and in many studies, “the experimenter neglected to collect reports to *show* [italics added] how the subjects interpreted their task and how they worked on it” (p. 737). This old interpretation has become more prevalent in recent years, maybe because the new generation has forgotten why it was ever abandoned. They should be more careful—or they should read Watson’s (1920) paper and Ericsson and Simon’s (1993) book.

## COGNITION

### *Imagery*

Mental imagery was a major issue in 19th-century philosophical and scientific psychology, and it continued to be a major topic until the behavioristic revolution. It was not killed in the behavioristic revolution, but it was certainly not healthy until it was revived

in the cognitive revolution of the 1960s. Holt (1964) called the return of imagery to the mainstream “the return of the ostracized,” but what returned was the word, not the concept.

In classical psychology, a distinction was made between *sensory* and *verbal* images (e.g., Calkins, 1916, pp. 197–201; James, 1890, pp. 265–266; for other references, see Reese, 1965). In behaviorism the corresponding distinction was between conditioned sensory and vocal responses (e.g., F. Allport, 1955, p. 449; Staats & Staats, 1963, pp. 143–147; Watson, 1929, footnote 1, p. 362), and in modern cognitive psychology it became *images* versus *words* or, more sonorously, *iconic representations* versus *lexical representations*.

In classical psychology, most of the research on imagery dealt with its structural characteristics, including characteristics that allow persons to distinguish images from sensations or perceptions. Examples from the late 1890s to the late 1920s are studies on the time course of memory images (Baldwin & Shaw, 1895; Warren & Shaw, 1895), afterimages of color images (Downey, 1901), and characteristics of images such as color, distinctiveness, intensity, and size (Alexander, 1904; G. Allport, 1924, 1928; Schaub, 1911). Calkins summarized research of this kind in her 1916 introductory psychology textbook (e.g., pp. 185–187). The roles of images in thinking (e.g., Comstock, 1921) and in memory (e.g., Calkins, 1916, p. 215) were also studied in that era, but they reflected structuralism rather than functionalism. By the 1930s most of the imagery research was on the mnemonic function of images (e.g., Bowers, 1931; Fernberger, 1937, pp. 207–208), presumably reflecting functionalism. However, the well-known study by Carmichael, Hogan, and Walter (1932) dealt with the nature of memory images, specifically the effects of language on the contents of visual memory images, which is a structuralist issue.

After the cognitive revolution, much



research was conducted on the functional role of imagery in personality and psychotherapy (e.g., Holt, 1964; Sheikh, 1984). However, most of the imagery research was still on the mnemonic function of images. Examples are research by Paivio (1971), Bower (e.g., 1972), Kosslyn (1980), and Reese (e.g., 1970, 1977). My first study of the mnemonic function of images (Reese, 1965) was motivated by a Watsonian belief that imagery is a chimera and that effects attributed to it are explainable by speech, or "language habits" as Watson said (1914, p. 324). To my surprise, I found that imagery and verbalization had separable effects.

Interest in the mnemonic function of imagery declined after a few years of intensive research, largely, I believe, because of the rise of computer simulation in cognitive psychology. Imagery cannot be directly represented in computer simulation, and mnemonic imagery theories came to be replaced by various verbal-list models, which are easy to represent in computer simulation. Thus, Watson's anti-imagery position recurred, but the rationale for it was different. Kosslyn (1980, chap. 2) presented a useful overview of the anti-imagery arguments.

### *Thinking*

The major issue about thinking is its relation to language (or speech; the distinction is ignored in the present paper). Sokolov (1972, chap. 1) presented a history of theories of the relation between thinking and language from Heraclitus to the middle decades of the 20th century, and Müller (1887, pp. 51–60) presented a brief history from Abelard in the 12th century to Hegel and other mid-19th-century philosophers. I will mention only some 20th-century highlights. Watson is well known for his theory that thinking is subvocal talking, but his actual theory was that thinking consists largely of subvocal talking but also involves the whole body and sometimes does not involve subvocal talking at all (e.g.,

1920, 1930, chap. 10–11). Piaget's theory was similar (e.g., 1955, p. 26, 1974, p. 11), although unlike Watson he gave an important role to images or, as he called them, "figurative aspects of thought" (Piaget, 1970, footnote 3, p. 705, pp. 717–718).

Consistently with behaviorists, Soviet psychologists admitted nonverbal thinking (e.g., Tikhomirov, 1972/1981) but emphasized "verbal" thinking. Examples of the emphasis are that Vygotsky (1934/1962, p. 152) rejected the idea that mature thinking can be unrelated to language; Rubinshteyn said, "Thought in the strict sense of the word is impossible without speech" (as quoted by Payne, 1968, p. 129); and according to a Soviet psychology textbook published in the late 1980s (*Psychology*, 1986/1989), "Thoughts do not exist outside language" (p. 300) and thinking is "*inseparable from speech*" (p. 317) and "*impossible without language*" (p. 320).

In the behavior-analytic view, language is behavior (e.g., Catania, 1992, p. 227). However, to borrow Orwell's phrase (1946, p. 112), even if all behaviors are equal, speaking is "more equal" than the others because of its roles in thinking and, more specifically, in control by rules. Rules can control behavior only if they are expressed in language (implied by Catania, 1992, pp. 248–249; Malott, 1989; stated by Piaget, 1955, p. 26; Reese, 1989, 1992).

### CAUSES OF THE RECURSIONS

Most of the recursions that have occurred in the behavioral sciences, including all the recursions discussed in the present paper, seem to have been spontaneous rather than based on deliberate historical research into the field. My interpretation is that these recursions reflect unresolved issues. Behavioral scientists identified certain issues as important and attacked these issues theoretically and empirically. They resolved some of the issues and

moved on, but found other issues intractable, perhaps because of the way they formulated these issues or because of limitations in the current theories or empirical methodologies. Whatever the reason, the intractable issues drifted out of the mainstream, but because they had not been resolved, they did not disappear. They eventually intrigued a new generation of behavioral scientists, who reinterpreted them in light of the intervening theoretical and empirical developments in the field and attacked them again in light of intervening methodological developments. If the new attacks failed, the cycle recurred in a later generation.

The foregoing interpretation reprises a suggestion Watson gave in his 1913 paper. The recursion was spontaneous because when I wrote the interpretation, I had forgotten Watson's suggestion or at least I was not aware of remembering it. Watson said that the classical introspective method of studying complex behaviors such as imagination, judgment, reasoning, and conception had failed and that appropriate behavioral methods had not yet been developed. He said that because of the classical treatment, issues about complex behaviors

may well be put away for a time. As our methods become better developed it will be possible to undertake investigations of more and more complex forms of behavior. Problems which are now laid aside will again become imperative, but they can be viewed as they arise from a new angle and in more concrete settings. (p. 175)

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